

REMARKS

The Application has been carefully reviewed in light of the final Office Action dated October 7, 2002 (Paper No. 12). Claims 1 to 16, 23 to 26, 28, 30, 32, 34, 35, 37 to 41 and 43 to 58 are in the application, of which Claims 1, 23 and 40 are the independent claims. Reconsideration and further examination are respectfully requested.

Claims 24 to 26, 28, 30, 32 and 47 to 50 were rejected under 35 U.S.C. § 112, second paragraph for alleged indefiniteness. Applicants thank the Examiner for her suggested changes to overcome the rejection. In keeping with these suggestions, Applicants have amended Claims 24, 28, 30, 32 and 47 to improve the clarity of the claims.

Applicants also thank the Examiner for of the indication of allowable subject matter in Claims 23 and 40. Accordingly, Claims 23 and 40 have been rewritten in independent form including all of the limitations of Claim 1 and are believed to be in condition for allowance. Such action is courteously solicited.

Claims 1, 10, 12 to 16, 37 to 38, 41 and 43 to 58 were rejected under 35 U.S.C. § 102(e) over U.S. Patent No. 6,007,945 (Jacobs), Claims 2 to 9 were rejected under 35 U.S.C. § 103(a) over Jacobs, and Claims 1, 10 to 22, 24 to 35, 37 to 39, 41 and 43 to 58 were rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 5,780,181 (Idota). Reconsideration and withdrawal of these rejections are respectfully requested.

The present invention is concerned with providing an improved rechargeable lithium battery with superior resistance to anode deterioration due to repeated charging/discharging of the battery over time. A prolonged charging and discharging cycle life, a gently-sloping discharge curve, high capacity and high energy density are some of the advantageous features the present invention provides.

According to Claim 1, the present invention concerns an electrode material for an anode of a rechargeable lithium battery. The electrode material contains a particulate comprising an amorphous $\text{Sn}\cdot\text{A}\cdot\text{X}$ alloy with a substantially non-stoichiometric ratio composition. In the $\text{Sn}\cdot\text{A}\cdot\text{X}$ formula, A indicates at least one kind of an element selected from the group consisting of transition metal elements, and X indicates at least one kind of an element selected from the group consisting of N, Mg, Ba, Sr, Ca, La, Ce, Si, Ge, C, P, B, Pb, Bi, Sb, Al, Ga, In, Tl, Zn, Be, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, As, Se, Te, Li and S. X is optionally present and the content of the constituent element Sn of the amorphous $\text{Sn}\cdot\text{A}\cdot\text{X}$ alloy is $\text{Sn}/(\text{Sn} + \text{A} + \text{X}) = 20$ to 80 atomic%.

The Office Action relies on Jacobs in a § 102(e) rejection. According to the Office Action, Jacobs teaches that an anode active substance made of a tin and titanium combination is known. Thus, the Office Action asserts $\text{Sn}\cdot\text{A}\cdot\text{X}$, wherein A is a transition metal and X is optionally present, is anticipated by Jacob's disclosure.

Applicants respectfully disagree with the position taken by the Office Action. While Jacobs may suggest that tin and titanium may combine in known ratios, Jacobs is not seen to disclose the use of the tin-titanium combination in an anode.

Jacobs is seen to describe an electrode for a rechargeable lithium battery that comprises a solid solution of titanium dioxide and tin dioxide. The disclosure concerning Ti_3Sn , Ti_2Sn , etc. is seen only to reveal known intermetallic compound compositions and their stoichiometric ratios. There is no indication that the non-oxidized tin-titanium combinations could be used as an anode active material. The disclosure of known stoichiometric ratios of titanium and tin is used only as a guide to prepare Jacobs' combination of TiO_2 and SnO_2 .

Hence, Jacobs is merely seen to suggest that the titanium dioxide-tin dioxide mixture should be based on ratios associated with the known ratios of tin and titanium. Applicants do not interpret Jacobs to mean that tin and titanium mixtures are known to be used as anode active materials. Furthermore, in Applicants' view, it is improper to apply limitations such as particle size and the presence of electrolytes to the known stoichiometric ratios, which were not the object of the patent. Still further, Applicants wish to make it clear that the anode material of Jacobs is an oxide material. Jacobs' anode is a solid solution of titanium dioxide and tin dioxide, to be contrasted with and distinguished from the present invention, an alloy compound of titanium and tin which does not contain oxygen. In light of the foregoing, the present invention is seen to be distinguished from the disclosure in Jacobs.

The Office Action relies on Idota in a § 102(b) rejection. The present invention concerns a non-oxide amorphous $\text{Sn} \cdot \text{A} \cdot \text{X}$ alloy which contains at least one transition metal element, to be contrasted with the invention of Idota which does not contain transition metals and relates mostly to oxide materials. The present invention is not seen to be anticipated by Idota.

Idota is seen to disclose an electrode active material that contains atoms from group IIIB, IVB or VB of the periodic table. The electrode material is represented by formulas (I), (II), (III), (IV) and (V) in column 4, line 20, to column 5, line 44. Since formulas (III), (IV) and (V) all require the presence of oxygen, they are easily distinguished from the present invention. Formulas (I) and (II), formula (I) being the broadest of the two, are not seen to include the use of transition metals. As shown in lines 20 to 45 of column 4, formula (I), represented as $\text{M}^1\text{M}_p^2\text{M}_q^4$, contains Si, Ge, Pb, P, B, Al, As, Sb, O, S, Se and

Te. These elements are not transition metal elements, therefore, formula (I) is not seen to disclose the present invention.

In regards to lines 39 to 49 of column 7, it is not clear how one of ordinary skill in the art would be enabled to use that disclosure to make the present invention. That portion of Idota casually mentions that, in addition to the elements already listed, nearly half of the elements in the periodic chart may be contained in Idota's compounds.

Applicants believe that it would require more than ordinary skill to arrive at the invention using broad language cited. A generic chemical formula will only anticipate a claimed species when the claimed species can be "at once envisaged" from the generic formula.

See MPEP 2131.02.

In addition, Idota is not seen to teach how these elements might be incorporated (for example, as part of an amorphous alloy or as a new mixture) nor is Idota seen to teach the benefits of the addition of transition metals. Of the numerous examples of compounds listed in the Idota patent, none are seen to disclose the combination of tin with a transition metal. In light of these shortcomings, Applicants respectfully submit that Idota is not an enabled disclosure for the combination of tin and a transition metal for use as a negative electrode active material.

For the reasons stated above, withdrawal of the § 102(b) rejection based on Idota is respectfully requested.

Consequently, neither Jacobs nor Idota are seen to disclose the present invention and thus do not anticipate Claim 1.

The remaining pending claims are each dependent from Claim 1 discussed above and are therefore believed patentable for the same reasons. Because each dependent

claim is also deemed to define an additional aspect of the invention, however, the individual consideration of each claim on its own merits is respectfully requested.

No other matters having been raised, the entire application is believed to be in condition for allowance and such action is respectfully requested at the Examiner's earliest convenience.

Applicants' undersigned attorney may be reached in our Costa Mesa, California office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,


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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Three Times Amended) An electrode material for an anode of a rechargeable lithium battery, containing a particulate comprising an amorphous $\text{Sn} \cdot \text{A} \cdot \text{X}$ alloy with a substantially non-stoichiometric ratio composition, wherein in said formula $\text{Sn} \cdot \text{A} \cdot \text{X}$, A indicates at least one kind of an element selected from the group consisting of transition metal elements, X indicates at least one kind of an element selected from the group consisting of [O, F,] N, Mg, Ba, Sr, Ca, La, Ce, Si, Ge, C, P, B, Pb, Bi, Sb, Al, Ga, In, Tl, Zn, Be, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, As, Se, Te, Li and S, where the element X is optionally present and the content of the constituent element Sn of the amorphous $\text{Sn} \cdot \text{A} \cdot \text{X}$ alloy is $\text{Sn}/(\text{Sn} + \text{A} + \text{X}) = 20$ to 80 atomic%.

17. (Cancelled).

18. (Cancelled).

19. (Cancelled).

20. (Cancelled).

21. (Cancelled).

22. (Cancelled).

23. (Amended) An electrode material for an anode [according to claim 1,] of a rechargeable lithium battery, containing a particulate comprising an amorphous Sn•A•X alloy with a substantially non-stoichiometric ratio composition, wherein in said formula Sn•A•X, A indicates at least one kind of an element selected from the group consisting of transition metal elements, X indicates at least one kind of an element selected from the group consisting of O, F, N, Mg, Ba, Sr, Ca, La, Ce, Si, Ge, C, P, B, Pb, Bi, Sb, Al, Ga, In, Tl, Zn, Be, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, As, Se, Te, Li and S, where the element X is optionally present and the content of the constituent element Sn of the amorphous Sn•A•X alloy is $\text{Sn}/(\text{Sn} + \text{A} + \text{X}) = 20$ to 80 atomic%, and wherein said particulate comprising said amorphous Sn•A•X alloy contains carbon element.

24. (Twice Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy contains at least one kind of an element selected from a group (a) consisting of Pb, Bi, Al, Ga, In, Tl, Zn, Be, Mg, Ca, and Sr; a group (b) consisting of rare earth elements in X; and a group (c) consisting of metalloide elements in X, wherein said group (b) consisting of rare earth elements consists of La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho,

Er, Tm, Yb, and Lu, and said group (c) consisting of metalloide elements consists of B, C, Si, P, Ge, As, Se, Sb, and Te.

27. (Cancelled).

28. (Twice Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy contains one kind of an element selected from a group consisting of Pb, Bi, Al, Ga, In, Tl, Zn, Be, Mg, Ca, and Sr and one kind of an element selected from a group consisting of rare earth elements in X, wherein said group consisting of rare earth elements consists of La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu.

29. (Cancelled).

30. (Twice Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy contains one kind of an element selected from a group consisting of Pb, Bi, Al, Ga, In, Tl, Zn, Be, Mg, Ca, and Sr and one kind of an element selected from a group consisting of metalloide elements in X, wherein said group consisting of metalloide elements consists of B, C, Si, P, Ge, As, Se, Sb, and Te.

31. (Cancelled).

32. (Twice Amended) An electrode material for an anode according to claim 1, wherein said amorphous $\text{Sn}\cdot\text{A}\cdot\text{X}$ alloy contains at least one kind of an element selected from a group consisting of metalloide elements in X and one kind of an element selected a group consisting of rare earth elements in X, wherein said group consisting of rare earth elements consists of La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu, and said group consisting of metalloide elements consists of B, C, Si, P, Ge, As, Se, Sb, and Te.

33. (Cancelled).

40. (Amended) An electrode material for an anode [according to claim 1,] of a rechargeable lithium battery, containing a particulate comprising an amorphous $\text{Sn}\cdot\text{A}\cdot\text{X}$ alloy with a substantially non-stoichiometric ratio composition, wherein said formula $\text{Sn}\cdot\text{A}\cdot\text{X}$, A indicates at least one kind of an element selected from the group consisting of transition metal elements, X indicates at least one kind of an element selected from the group consisting of O, F, N, Mg, Ba, Sr, Ca, La, Ce, Si, Ge, C, P, B, Pb, Bi, Sb, Al, Ga, In, Tl, Zn, Be, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, As, Se, Te, Li and S, where the element X is optionally present and the content of the constituent element Sn of the amorphous $\text{Sn}\cdot\text{A}\cdot\text{X}$ alloy is $\text{Sn}/(\text{Sn}+\text{A}+\text{X}) = 20$ to 80 atomic %, and wherein said amorphous $\text{Sn}\cdot\text{A}\cdot\text{X}$ alloy contains at least one kind of an element selected from a group consisting of N and S in an amount in a range of from 1 atomic % to 30 atomic %.

47. (Amended) A rechargeable lithium battery having an anode, an electrolyte, and a cathode and in which oxidation-reduction reaction of lithium is used, characterized in that said anode comprises said electrode structural body defined in any of claims 41 and 43 to 46.